

A Quasi-Experimental Methodology for Evaluating Risk Reduction in Kenyan Municipal Infrastructure Asset Systems

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ABSTRACT

Background: Municipal infrastructure asset systems in Kenya face significant and escalating risks from climate change, population growth, and ageing assets. Current evaluation methods for risk reduction interventions are often descriptive or rely on pre-post comparisons lacking counterfactual rigour, limiting causal inference and robust investment prioritisation.

Purpose and objectives: This article presents a novel quasi-experimental methodology designed to causally evaluate the effectiveness of engineering interventions aimed at reducing systemic risk within municipal infrastructure asset portfolios. The objective is to provide a structured, evidence-based framework for measuring risk reduction outcomes.

Keywords: *quasi-experimental design, municipal infrastructure, asset management, Sub-Saharan Africa, risk assessment, engineering methodology*

Article Highlights

- Employs a difference-in-differences design with treated and matched control groups.
- Quantifies causal effects using key risk metrics: probability and consequence of failure.
- Controls for secular trends like seasonal rainfall to isolate intervention impact.
- Uses cluster-robust standard errors to account for spatial correlation in data.

Core Statistical Model

$\Delta\text{Risk}_{it} = \beta_0 + \beta_1\text{Treat}_i + \beta_2\text{Post}_t + \beta_3(\text{Treat}_i \times \text{Post}_t) + \varepsilon_{it}$, where β_3 captures the causal treatment effect.

This is a methodology paper presenting a novel evaluative framework, not empirical results.

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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